dpr

Department of Pesticide Regulation

Paul Helliker
Director

Gray Davis
Governor

Winston H. Hickox
Secretary, California Environmental Protection Agency

MEMORANDUM

TO: Bob Rollins
Agriculture Program Supervisor III
Environmental Monitoring Branch

FROM: Don J. Weaver, Ph.D. DJW
Senior Environmental Research Scientist (Supervisor)
Environmental Monitoring Branch
(916) 324-4132

Craig Nordmark CeM
Associate Environmental Research Scientist
Environmental Monitoring Branch
(916) 324-4138

DATE: June 30, 2002

SUBJECT: SUMMARY OF RESULTS FOR FISCAL YEAR 2000/01 GROUND WATER PROTECTION LIST MONITORING FOR FENAMIPHOS, FENAMIPHOS SULFOXIDE, AND FENAMIPHOS SULFONE

SUMMARY

Fenamiphos was chosen for monitoring from active ingredients (AIs) on the Ground Water Protection List (GWPL). Sixty wells were sampled in nine counties during September-November, 2001. No residues of fenamiphos or the degradates fenamiphos sulfoxide or fenamiphos sulfone were detected in any of the wells. Thirty-four wells did contain residues of one or more herbicides or herbicide degradates.

BACKGROUND

In 1987, a group of 45 pesticide AIs was put into regulation as the Ground Water Protection List (Title 3, California Code of Regulations section 6800[b]), compounds which have the potential to pollute ground water through normal agricultural use. A monitoring protocol for GWPL AIs developed in 1988 required that compounds on the list be prioritized before monitoring was conducted (1). From 1992 through 1999, a total of 20 of the highest priority AIs (2)(3)(4)(5)(6)(7)(8)(9) were monitored with between 25 and 40 wells sampled for each AI.

A revised protocol for GWPL monitoring was approved in 1997 (10) and is now used to select AIs for monitoring. Under the new protocol, compounds on the GWPL are not formally prioritized. Rather, AIs are selected for monitoring based on current information about their physico-chemical characteristics, cultural practices for crops on which they are applied, detections in ground water anywhere in the United States, and any other pertinent information.

Alachlor and metolachlor, along with two degradates of each, were selected using the revised protocol and were monitored during fiscal year (FY) 2001/02 (11).

The nematicide fenamiphos, along with the degradates fenamiphos sulfoxide and fenamiphos sulfone, was also selected for monitoring during FY 2001/02. Monitoring for these chemicals in California had been conducted by the Environmental Monitoring Branch (EM) in 1987 (12). In that study, 41 wells were sampled in Fresno, Kern, and San Joaquin counties but no fenamiphos residues were detected. Since that time, use of fenamiphos has increased in the state.

METHODS

Wells were sampled for fenamiphos, fenamiphos sulfoxide, and fenamiphos sulfone during September-November, 2001. EM staff conducted some of the monitoring and some were done in collaboration with a study being conducted by the U.S. Geological Survey (USGS) and included samples collected by USGS staff and some co-sampling done by the two agencies.

The collaborative effort with the USGS included 29 wells. An EM staff member was present to co-sample 18 wells, including 3 monitoring wells. One bottle of water was taken for analysis by the California Department of Food and Agriculture (CDFA) laboratory. Eleven wells were sampled only by USGS personnel and one sample from each of seven of those wells was submitted to EM for analysis of the three fenamiphos compounds. For the remaining four wells, two primary well samples and a field blank sample were submitted to EM. One bottle was used for fenamiphos analysis and the other for analysis of herbicides in an analytical screen.

EM sampled an additional 31 wells. Areas to be surveyed for well sampling were selected based on Pesticide Use Report information for 1994-1999. Counties were listed in descending order for use of fenamiphos, and the counties with the greatest use were selected. Sections were chosen within each county where the greatest quantities of the pesticides had been applied. Those sections that had coarse soil types and shallow depth to ground water were targeted as primary locations for monitoring. Sampling crews drove through pre-selected sections of land in each county with the goal of sampling one well per section. For each well sampled, two primary, four backup, and two field blank samples were collected.

The CDFA laboratory performed analyses for fenamiphos, fenamiphos sulfoxide, and fenamiphos sulfone using APCI/LC/MS/MS with a reporting limit (RL) of 0.05 parts per billion (ppb) for all chemicals. Water samples from 60 different wells were analyzed. When more than one sample was submitted per well, the PTRL West, Inc. laboratory analyzed the second sample for 10 herbicide chemicals using a LC/MS/MS analytical screen. The analytes and their reporting limits were: atrazine 0.031 ppb, simazine 0.035 ppb, DEA 0.035 ppb, ACET 0.032 ppb, DACT 0.057 ppb, prometon 0.022 ppb, hexazinone 0.082 ppb, norflurazon 0.021 ppb, bromacil 0.022 ppb, and diuron 0.022 ppb. This analytical method was determined to

be unequivocal for the ten analytes (13). The CDFA laboratory also analyzed backup samples from five wells using a LC/MS/MS analytical screen with a RL of 0.05 ppb for the same chemicals analyzed for by the PTRL laboratory.

Use of fenamiphos was documented from Pesticide Use Reports for 1994-1999. The total number of pounds applied was determined for each section in which a well was sampled and also for the eight adjoining sections surrounding the monitored section. Land use characteristics were also determined for each section of land in which a well was sampled. The percentage of each land use type was determined based on 1993-1996 Department of Water Resources maps.

RESULTS

A total of 60 wells were sampled in nine counties but no fenamiphos, fenamiphos sulfoxide, or fenamiphos sulfone residues were detected in any of the wells (Table 1). Several wells contained one or more herbicide residues, including nine in Fresno County, four in Kern County, two in Madera County, five in Merced County, three in Monterey County, three in San Joaquin County, three in Stanislaus County, and four in Tulare County. No herbicide residues were detected in any of the Sonoma County wells.

Atrazine was found in 4 wells, simazine in 19, bromacil in 9, diuron in 13, and norflurazon in 6. Also detected were degradates of atrazine and simazine:
DEA (2-amino-4-chloro-6-isopropylamino-s-triazine or deethylatrazine),
ACET (2-amino-4-chloro-6-ethylamino-s-triazine, also known as deisopropylatrazine or deethylsimazine), and DACT (2,4-diamino-6-chloro-s-triazine, also known as didealkylated triazine when it is not known if parent compound is atrazine or simazine). Residues of DEA were found in 3 wells, ACET in 24, and DACT in 20.

The analytical method used by the PTRL West laboratory is unequivocal for ten herbicide analytes; thus no verification of those results are necessary. When both laboratories analyzed water from the same wells, detections of the same herbicide compounds were made for 23 analyses. The PTRL West laboratory detected herbicide residue in five more samples where the CDFA laboratory did not; this was due to the lower RLs reported for the PTRL West laboratory.

Fenamiphos use data and land use characteristics are presented by county in Tables 2-10. In each table, the total number of pounds of fenamiphos, bromacil, diuron, simazine, and norflurazon applied during the years 1994-1999 are presented for the section in which a well was sampled (in section) and also as a total for that section plus the eight adjoining sections (9-section).

DISCUSSION

Monitoring was first conducted for fenamiphos residues in California ground water in 1987. In that study 41 wells were sampled in Fresno County, Kern County, and San Joaquin County but no fenamiphos, fenamiphos sulfoxide, or fenamiphos sulfone was detected. Monitoring for these compounds was conducted again in 2001, approximately 14 years later. Again, none of the fenamiphos compounds were detected in any of 60 wells. The same counties used in the first study were again monitored, plus six additional counties where fenamiphos had been applied. Use of the compound in California showed a general increase over the past several years.

The widespread use of fenamiphos in the areas sampled suggested a potential for ground water contamination. Although no residues were detected, residues of certain herbicides were found in well water in 8 of the 9 counties tested. These detections indicated spatial vulnerability to ground water contamination in those areas. However, the lack of detections of the fenamiphos compounds indicates that movement is mitigated as a result of specific use practices, some aspect of the physical/chemical properties, or some combination of these factors.

REFERENCES CITED

1. Weaver, D. November 30, 1988. Protocol for ranking the ground water protection list for contamination potential and for subsequent monitoring under commercial agricultural conditions.

2. Weaver, D. and J. Marade. July 15, 1992. Memorandum to K. Goh: Summary of results for FY 1991-92 ground water protection list monitoring.

3. Weaver, D. and J. Marade. August 23, 1993. Memorandum to J. S. Sanders: Summary of results for FY 1992-93 ground water protection list monitoring.

4. Weaver, D. and J. Marade. August 19, 1994. Memorandum to K. S. Goh: Summary of results for FY 1993-94 ground water protection list monitoring.

5. Weaver, D. and J. Marade. June 30, 1995. Memorandum to K. S. Goh: Summary of results for FY 1994-95 ground water protection list monitoring.

6. Weaver, D. and J. Marade. August 21, 1996. Memorandum to K. S. Goh: Summary of results for FY 1995-96 ground water protection list monitoring.

7. Weaver, D. and J. Marade. June 30, 1997. Memorandum to K. S. Goh: Summary of results for FY 1996-97 ground water protection list monitoring.

8. Weaver, D. and J. Marade. June 30, 1998. Memorandum to K. S. Goh: Summary of results for FY 1997-98 ground water protection list monitoring.

9. Weaver, D. and J. Marade. March 19, 1999. Memorandum to K. S. Goh: Summary of results for FY 1998-99 ground water protection list monitoring.

10. Weaver, D. J. April 8, 1997. Revised protocol for selecting Ground Water Protection List active ingredients to be monitored under certain agricultural conditions.

11. Weaver, D. J. and C. Nordmark. May 6, 2002. Memorandum to Bob Rollins: Summary of results for fiscal year 2001-02 ground water protection list monitoring for alachlor, metoloachlor and two degradates of each.

12. Troiano, John, Bonnie Turner, and Nancy Miller. 1987. Sampling for residues of Fenamiphos, fenamiphos sulfoxide and fenamiphos sulfone in well water. California Department of Food and Agriculture, Environmental Hazards Assessment Program, EH 87-8. 31 pp.

13. Spurlock, Frank. May 17, 2002. Memorandum to Kean S. Goh: Determination if the PTRL West, Inc., liquid chromatography/atmospheric pressure chemical-ionization/mass spectrometry/mass spectrometry method for selected herbicides and degradates in water (PTRL Method 1000Wymsms7b), meets the "unequivocal detection" criteria.

Table 1. Detections of pesticides in wells sampled for fenamiphos, fenamiphos sulfoxide and fenamiphos sulfone during 2000-2001 Ground Water Protection List monitoring. No fenamiphos residues were found in any of the wells. Only data for pesticides that were detected are presented. For samples analyzed by two laboratories, CDFA[a] laboratory results are shown on the first line, PTRL[b] laboratory results are shown on the second line. One line of data is presented for samples analyzed only by the PTRL Laboratory or not analyzed for herbicides.

			Concentration, parts per billion							
County	Township/Range-Section	Well sampled by[c]	Atrazine	Simazine	DEA	ACET	DACT	Diuron	Bromacil	Norflurazon
Fresno	13S/17E-28	USGS	-[d]	-	-	-	-	-	-	-
	13S/18E-21	USGS	-	-	-	-	-	-	-	-
	14S/18E-15	USGS	-	-	-	-	-	-	-	-
	14S/18E-30	DPR	ND[e]	ND	ND	0.041	0.064	ND	ND	ND
	14S/19E-05	USGS	-	-	-	-	-	-	-	-
	14S/21E-14	DPR/USGS	ND	0.141	ND	0.761	1.115	ND	ND	ND
			ND	0.131	ND	0.528	0.896	ND	ND	ND
	14S/22E-03	DPR	ND	0.057	ND	0.347	0.473	0.145	1.054	0.05
			ND	0.048	ND	0.249	0.461	0.096	0.971	0.03
	14S/22E-08	DPR/USGS	ND	0.053	ND	0.410	0.456	0.434	0.231	ND
			0.046	0.071	ND	0.347	0.450	0.310	0.226	0.032
	15S/19E-25	DPR	ND	0.05	ND	ND	ND	ND	ND	ND
	15S/22E-03	DPR	ND	0.056	ND	0.041	ND	0.258	ND	ND
	16S/19E-11	USGS	-	-	-	-	-	-	-	-
	16S/19E-22	DPR	ND	0.063	ND	0.099	0.059	ND	ND	ND

Table 1. Continued.

County	Township/Range-Section	Well sampled by	Concentration, parts per billion							
			Atrazine	Simazine	DEA	ACET	DACT	Diuron	Bromacil	Norflurazon
Fresno	16S/20E-09	DPR/USGS	ND	0.064	ND	0.236	0.273	ND	ND	ND
	16S/20E-15	DPR	ND	0.073	ND	0.126	0.104	ND	ND	ND
	16S/20E-26	DPR	ND	0.096	ND	0.323	0.209	ND	ND	ND
	16S/22E-34	USGS	-	-	-	-	-	-	-	-
Kern	25S/25E-31	DPR	ND	0.054	ND	ND	ND	ND	ND	ND
	25S/26E-01	DPR	ND	0.04	ND	0.052	ND	ND	ND	ND
	25S/26E-16	DPR	ND	0.121	ND	0.203	0.118	0.186	0.025	ND
	26S/25E-09	DPR	ND	ND	ND	ND	ND	0.023	ND	ND
	28S/26E-11	DPR	ND	ND	ND	ND	ND	ND	ND	ND
Madera	11S/17E-28	DPR/USGS	ND	ND	0.050	0.084	0.231	ND	ND	ND
			0.048	ND	0.062	0.125	0.225	ND	0.033	ND
	12S/17E-22	DPR/USGS	0.115	0.154	0.073	0.502	0.563	0.157	ND	ND
			0.106	0.126	0.084	0.530	0.505	0.120	0.033	ND
	12S/18E-29	DPR/USGS	ND	ND	ND	ND	ND	ND	ND	ND
Merced	05S/11E-34	DPR/USGS	ND	0.092	ND	0.298	0.594	ND	ND	ND

Table 1. Continued.

County	Township/Range-Section	Well sampled by	Concentration, parts per billion							
			Atrazine	Simazine	DEA	ACET	DACT	Diuron	Bromacil	Norflurazon
Merced	06S/12E-05	DPR/USGS	ND	ND	ND	ND	ND	ND	0.025	ND
	06S/12E-34	DPR/USGS	ND	ND	ND	ND	ND	ND	0.025	ND
	06S/12E-34 Monitoring Well	DPR/USGS	ND	ND	ND	ND	ND	0.034	ND	ND
	07S/12E-18	DPR/USGS	ND	ND	ND	0.043	ND	ND	ND	0.046
Monterey	15S/04E-08	DPR	ND	ND	ND	ND	ND	ND	ND	ND
	15S/04E-16	DPR	ND	ND	ND	ND	ND	ND	ND	ND
	15S/04E-26	DPR	ND	ND	ND	ND	ND	0.078	ND	ND
	15S/04E-35	DPR	ND	0.041	ND	0.048	ND	ND	ND	ND
	15S/04E-35	DPR	ND	ND	ND	ND	ND	ND	0.036	ND
	15S/04E-36	DPR	ND	ND	ND	ND	ND	ND	ND	ND
	16S/04E-35	DPR	ND	ND	ND	ND	ND	ND	ND	ND
	20S/08E-21	DPR	ND	ND	ND	ND	ND	ND	ND	ND
San Joaquin	04N/06E-20	USGS	-	-	-	-	-	-	-	-

Table 1. Continued.

County	Township/Range-Section	Well sampled by	Concentration, parts per billion							
			Atrazine	Simazine	DEA	ACET	DACT	Diuron	Bromacil	Norflurazon
San Joaquin	04N/07E-21	USGS	ND	ND	ND	ND	ND	ND	ND	ND
	01S/07E-27	DPR/USGS	ND	ND	ND	ND	0.065	ND	ND	ND
	02S/07E-20	DPR/USGS	ND	ND	ND	ND	ND	ND	ND	ND
	02S/07E-20 Monitoring Well	USGS	ND	ND	ND	0.068	0.513	ND	ND	ND
	02S/07E-22	USGS	ND	ND	ND	ND	ND	ND	ND	ND
	02S/09E-09	DPR/USGS	ND	ND	ND	0.057	0.262	0.044	ND	ND
Sonoma	09N/09W-02	DPR	ND	ND	ND	ND	ND	ND	ND	ND
	10N/09W-27	DPR	ND	ND	ND	ND	ND	ND	ND	ND
	10N/09W-36	DPR	ND	ND	ND	ND	ND	ND	ND	ND
	10N/10W-12	DPR	ND	ND	ND	ND	ND	ND	ND	ND
	10N/10W-12	DPR	ND	ND	ND	ND	ND	ND	ND	ND
	11N/10W-08	DPR	ND	ND	ND	ND	ND	ND	ND	ND
Stanislaus	03S/08E-05	USGS	ND	ND	ND	ND	ND	ND	ND	ND
	03S/10E-35	DPR/USGS	ND	ND	ND	ND	ND	ND	ND	ND
	03S/11E-30	DPR/USGS	0.054	ND	0.074	0.032	ND	ND	ND	ND

Table 1. Continued.

County	Township/Range-Section	Well sampled by	Concentration, parts per billion							
			Atrazine	Simazine	DEA	ACET	DACT	Diuron	Bromacil	Norflurazon
Stanislaus	04S/11E-31	DPR/USGS	ND	ND	ND	0.064	0.094	ND	ND	ND
	04S/11E-31 Monitoring Well	DPR/USGS	ND	ND	ND	ND	0.072	ND	ND	ND
Tulare	17S/26E-30	DPR	ND	0.096	ND	1.172	1.955	0.290	1.015	0.03
	17S/26E-35	DPR	ND	0.109	ND	0.539	0.775	0.155	ND	0.039
	18S/26E-04	DPR	ND	0.101	ND	0.249	0.288	0.053	ND	ND
	18S/27E-31	DPR	ND	0.064	ND	0.052	ND	0.038	ND	0.102
	24S/25E-23	DPR	ND	ND	ND	ND	ND	ND	ND	ND

[a] All samples analyzed by the CDFA laboratory were tested for fenamiphos, fenamiphos sulfoxide and fenamiphos sulfone. Some samples were also tested for atrazine, bromacil, diuron, hexazinone, norflurazon, prometon, simazine, deethylatrazine (DEA), deisopropylatrazine (ACET), and didealkylated triazine (DACT). The reporting limit for all chemicals was 0.05 parts per billion (ppb).

[b] All samples analyzed by the PTRL West laboratory were tested for atrazine, bromacil, diuron, hexazinone, norflurazon, prometon, simazine, deethylatrazine (DEA), deisopropylatrazine (ACET), and didealkylated triazine (DACT). The reporting limits in ppb for the PTRL West laboratory were: atrazine (0.031), bromacil (0.022), diuron (0.022), hexazinone (0.082), norflurazon (0.021), prometon (0.022), simazine (0.035), DEA (0.035), ACET (0.032) and DACT (0.057).

[c] Wells were sampled by staff from the Department of Pesticide Regulation (DPR), staff from the U. S. Geological Survey (USGS) or co-sampled by staff from both agencies.

[d] - = not analyzed for.

[e] ND = none detected at the reporting limit (RL) for that chemical. The RL is the smallest amount that can be reliably detected in a laboratory test; the RL is set by the testing laboratory for each chemical.

Table 2. Fresno County - Use of fenamiphos and selected herbicides and land use characteristics for sections of land in which one or more wells were sampled for 2000-2001 Ground Water Protection List monitoring.

	Fenamiphos Use		Bromacil Use		Diuron Use		Norflurazon Use		Simazine Use		Land Use[a] (percentage of the section land area)																Right-of-Way Features Present (x)					
Township/ Range-Section	In Section[b]	9-Section[c]	In Section	9-Section	In Section	9-Section	In Section	9-Section	In Section	9-Section	Oranges	Stone Fruit	Misc. Deciduous	Almonds	Walnuts	Cotton	Misc. Field Crop	Grain & Hay	Alfalfa	Pasture	Misc. Truck Crop	Grapes	Water	Farmstead	Dairy/ Poultry Farm	Urban Residential/ Landscaped	Vacant	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
13S/17E-28[c]	391	1323	-[d]	-	300	1490	423	1570	1982	12977				16						1		77		2		1	3	X	X				X
13S/18E-21	788	1479	-	-	660	3886	392	5097	2256	14953												98				2		X			X		
14S/18E-15	58	4156	-	-	27	1005	83	1470	886	10511				6						1		77		3		10	2	2	X					X
14S/18E-30	4228	4286	-	-	30	450	1009	1849	715	8556						17			16			63		1		2			X	X				X
14S/19E-05	44	378	-	-	301	1135	322	1395	878	6137						9	6		15			67		2			1	1	X	X	X			X
14S/21E-14	598	1850	-	-	101	5663	7	1286	863	12412	2		4	2			10		6	2	9	52		3	1	2	6		X		X		X	X
14S/22E-03	59	1216	67	2838	2422	13424	515	2817	3692	16172	32	4	1				2				3	51		1			6		X	X				X
14S/22E-08	-	645	-	-	98	5720	104	1531	704	13314	2	14	1	1				2		3		69					5	2	X	X	X			X
15S/19E-25	1232	9712	-	-	140	1738	354	2712	1165	10906												99		1					X	X		X		X
15S/22E-03	1486	3792	-	-	37	1670	69	2048	905	7456		14	1									76	2	3		4			X			X		X
16S/19E-11	863	5809	-	-	48	149	455	3352	1220	10086		2		25								71				2			X	X				
16S/19E-22	7069	18014	-	-	-	-	2680	8172	4257	17054		8										92		1					X	X				X
16S/20E-09	808	8142	-	-	68	405	152	3133	1433	17714							2					88		2		6	2		X					X
16S/20E-15	2754	5480	-	-	-	-	91	940	1060	17028		7		15	2		10				3	58		2	2	1			X	X				X
16S/20E-26	3344	7850	-	-	22	1545	1052	2225	1728	8276				21							2	73			4				X	X				X

[a] Fresno Co. land use data obtained from 1994 Department of Water Resources maps.

[b] Total pounds of pesticide applied from 1994-1999 in the monitored section, where well was located.

[c] Total pounds of pesticide applied from 1994-1999 in the monitored section plus the eight surrounding sections.

[d] None applied for 1994-1999.

Table 3. Kern County - Use of fenamiphos and selected herbicides and land use characteristics for sections of land in which one or more wells were sampled for 2000-2001 Ground Water Protection List monitoring.

	Fenamiphos Use		Bromacil Use		Diuron Use		Norflurazon Use		Simazine Use		Land Use[a] (percentage of the section land area)													Right-of-Way Features Present (x)					
Township/ Range- Section	In Section[b]	9-Section[c]	In Section	9-Section	In Section	9-Section	In Section	9-Section	In Section	9-Section	Orange	Almond	Grain	Misc. Field Crop	Corn	Alfalfa	Idle	Grapes	Native Vegetation	Water	Commercial	Cemetery, Park, School	Industrial	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
25S/25E-31	-[d]	2221	-	-	-	556	30	30	226	489		51			12	7		23	6		1	1		x	x	x			
25S/26E-01	1166	7456	-	2991	-	4645	-	112	1569	4746		25		9				62	2	1			2	x	x	x			x
25S/26E-16	860	10852	-	209	467	5420	-	508	2964	15443	3						2	79	3	14				x	x		x		x
26S/25E-09	3316	12952	-	-	2005	5839	-	754	753	2570						19		75		5			1	x	x		x		x
28S/26E-11	5161	11272	-	-	-	405	-	452	951	8707			10					83	3				4	x	x				

[a] Kern Co. land use data obtained from 1998 Department of Water Resources maps.

[b] Total pounds of pesticide applied from 1994-1999 in the monitored section, where well was located.

[c] Total pounds of pesticide applied from 1994-1999 in the monitored section plus the eight surrounding sections.

[d] None applied for 1994-1999.

Table 4. Madera County - Use of fenamiphos and selected herbicides and land use characteristics for sections of land in which one or more wells were sampled for 2000-2001 Ground Water Protection List monitoring.

	Fenamiphos Use		Diuron Use		Norflurazon Use		Simazine Use		Land Use[a] (percentage of the section land area)												Right-of-Way Features Present (x)					
Township/ Range-Section	In Section[b]	9-Section[c]	In Section	9-Section	In Section	9-Section	In Section	9-Section	Apples	Stone Fruit	Almond	Misc. Field Crop	Cotton	Corn	Pasture	Misc. Truck	Grapes	Farmstead	Urban Residential/ Landscaped		Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
11S/17E-28	612	1190	387	1466	52	1941	1082	7083			2	1	8	1	6	4	65	3	6	3	x	x				x
12S/17E-22	-[d]	278	86	1272	200	3288	1521	9407									98	2			x					x
12S/18E-29	-	1829	276	3415	166	2327	1977	12593	7	16	5						68	1	1	2	x					x

[a] Madera Co. land use data obtained from 1995 Department of Water Resources maps.

[b] Total pounds of pesticide applied from 1994-1999 in the monitored section, where well was located.

[c] Total pounds of pesticide applied from 1994-1999 in the monitored section plus the eight surrounding sections.

[d] None applied for 1994-1999.

Table 5. Merced County - Use of fenamiphos and selected herbicides and land use characteristics for sections of land in which one or more wells were sampled for 2000-2001 Ground Water Protection List monitoring.

	Fenamiphos Use		Norflurazon Use		Simazine Use		Land Use[a] (percentage of the section land area)													Right-of-Way Features Present (x)					
Township/ Range-Section	In Section[b]	9-Section[c]	In Section	9-Section	In Section	9-Section	Stone Fruit	Almond	Walnut	Grain	Misc. Field Crop	Idle	Pasture	Truck Crops	Grapes	Native Vegetation	Farmstead	Dairy/ Feedlot/ Poultry	Urban	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
05S/11E-34	-[d]	1300	29	1672	48	809	9	70	3		1			6	8		1		1	X	X				X
06S/12E-05	-	1530	35	1092	45	479		85		7		2		2		4			1	X	X	X			X
06S/12E-34	1102	6292	27	2212	202	1788	16	64			7	4	1	3			2	1	1	X					X
07S/12E-18	-	-	66	1415	29	260		78				2	1		12		1	6		X	X		X		X

[a] Merced Co. land use data obtained from 1995 Department of Water Resources maps.

[b] Total pounds of pesticide applied from 1994-1999 in the monitored section, where well was located.

[c] Total pounds of pesticide applied from 1994-1999 in the monitored section plus the eight surrounding sections.

[d] None applied for 1994-1999.

Table 6. Monterey County - Use of fenamiphos and selected herbicides and land use characteristics for sections of land in which one or more wells were sampled for 2000-2001 Ground Water Protection List monitoring.

	Fenamiphos Use		Diuron Use		Simazine Use		Land Use[a] (percentage of the section land area)											Right-of-Way Features Present (x)					
Township/ Range-Section	In Section[b]	9-Section[c]	In Section	9-Section	In Section	9-Section	Grain & Hay	Dry Beans	Misc. Truck Crop	Nursery	Grapes	Riparian	Native Vegetation	Water	Farmstead	Industrial	Vacant	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
15S/04E-08	2025	4286	-[d]	46	6	-			97	1					2			x	x			x	
15S/04E-16	594	12303	-	-	-	-	2		87	8			1		2		1	x	x		x		
15S/04E-26	5698	5698	57	114	-	1474	3		94				2	0	1			x	x				
15S/04E-35	2523	16450	-	141	-	2855	1	1	90		1		3	1	2			x	x			x	
15S/04E-36	-	13747	84	141	1474	3046	0		67		32			1				x	x			x	x
16S/04E-35	2093	3700	46	391	1023	1700			15		58	15	9	2	1			x	x			x	
20S/08E-20	-	5525	36	36	705	5773	2		46		21	15	14			1	2	x	x			x	

[a] Monterey Co. land use data obtained from 1997 Department of Water Resources maps for fall, spring and summer averaged together.

[b] Total pounds of pesticide applied from 1994-1999 in the monitored section, where well was located.

[c] Total pounds of pesticide applied from 1994-1999 in the monitored section plus the eight surrounding sections.

[d] None applied for 1994-1999.

Table 7. San Joaquin County - Use of fenamiphos and selected herbicides and land use characteristics for sections of land in which one or more wells were sampled for 2000-2001 Ground Water Protection List monitoring.

	Fenamiphos Use		Diuron Use		Norflurazon Use		Simazine Use		Land Use[a] (percentage of the section land area)																Right-of-Way Features Present (x)					
Township/ Range-Section	In Section[b]	9-Section[c]	In Section	9-Section	In Section	9-Section	In Section	9-Section	Misc. Deciduous	Stone Fruit	Almond	Walnut	Corn	Alfalfa	Pasture	Nursery	Grapes	Native Vegetation	Water	Farmstead	Urban	Residential	Vacant	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
01S/07E-27	-[d]	80	-	467	93	838	467	517			56		7		6	3	7	4		1	2	13	3	X					X
02S/07E-20	-	540	49	715	234	1369	381	2322			74		3	8	10					5				X					X
02S/09E-09	35	-	37	915	426	2134	764	5778	3	11	62	17			2				1	2			2	X	X	X			X
04N/06E-20	292	3296	604	4109	52	1200	1707	14647	3								97							X	X				X
02S/07E-22	-	857	-	354	53	1967	-	3594			94		3			2						1		X	X				X
04N/07E-21	44	1219	347	2406	85	1839	1014	7247	13					5		1	69	4		2	4		2	X	X				

[a] San Joaquin Co. land use data obtained from 1996 Department of Water Resources maps.

[b] Total pounds of pesticide applied from 1994-1999 in the monitored section, where well was located.

[c] Total pounds of pesticide applied from 1994-1999 in the monitored section plus the eight surrounding sections.

[d] None applied for 1994-1999.

Table 8. Sonoma County - Use of fenamiphos and selected herbicides for sections of land in which one or more wells were sampled for 2000-2001 Ground Water Protection List monitoring.

	Fenamiphos Use		Diuron Use		Norflurazon Use		Simazine Use		Right-of-Way Features Present (x)					
Township/ Range-Section	In Section[b]	9-Section[c]	In Section	9-Section	In Section	9-Section	In Section	9-Section	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
09N/09W-02	2979	6954	264	806	-[d]	33	1263	6842	x			x	x	
10N/09W-27	2907	4600	228	1147	-	6	1189	5718	x	x			x	
10N/09W-36	2574	7421	405	840	20	20	2780	8209	x	x			x	
10N/10W-12	297	385	7	11	-	112	662	3480	x	x			x	
11N/10W-08	3336	4157	114	165	10	27	1178	3779	x	x			x	

[a] No Department of Water Resources land use maps are available for Sonoma County.

[b] Total pounds of pesticide applied from 1994-1999 in the monitored section, where well was located.

[c] Total pounds of pesticide applied from 1994-1999 in the monitored section plus the eight surrounding sections.

[d] None applied for 1994-1999.

Table 9. Stanislaus County - Use of fenamiphos and selected herbicides and land use characteristics for sections of land in which one or more wells were sampled for 2000-2001 Ground Water Protection List monitoring.

	Fenamiphos Use		Diuron Use		Norflurazon Use		Simazine Use		Land Use[a] (percentage of the section land area)																Right-of-Way Features Present (x)					
Township/ Range-Section	In Section[b]	9-Section[c]	In Section	9-Section	In Section	9-Section	In Section	9-Section	Stone Fruit	Almond	Walnut	Misc. Field Crop	Corn	Dry Beans	Alfalfa	Pasture	Misc. Truck Crop	Vineyard	Native Vegetation	Farmstead	Poultry Farm	Urban	Idle/ Vacant	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
03S/08E-05	-[d]	1981	117	4125	174	1991	720	11444		41	42	0			2		0			1	1	1	11	X			X		X
03S/10E-35	-	-	202	766	156	2257	460	2834	36	12	8			4		7		17	1	1		11	2	X	X		X	X	X
03S/11E-30	-	96	107	1054	344	1427	564	3358	1	52	27	1	2			3	1		9	2		2		X			X	X	X
04S/11E-31	-	612	45	263	490	2480	365	2487		44		3	14		22	4		2		4	3	2	1	X		X	X		X

[a] Stanislaus Co. land use data obtained from 1996 Department of Water Resources maps.

[b] Total pounds of pesticide applied from 1994-1999 in the monitored section, where well was located.

[c] Total pounds of pesticide applied from 1994-1999 in the monitored section plus the eight surrounding sections.

[d] None applied for 1994-1999.

Table 10. Tulare County - Use of fenamiphos and selected herbicides and land use characteristics for sections of land in which one or more wells were sampled for 2000-2001 Ground Water Protection List monitoring.

	Fenamiphos Use		Bromacil Use		Diuron Use		Norflurazon Use		Simazine Use		Land Use[a] (percentage of the section land area)													Right-of-Way Features Present (x)					
Township/ Range-Section	In Section[b]	9-Section[c]	In Section	9-Section	In Section	9-Section	In Section	9-Section	In Section	9-Section	Citrus	Olive	Stone Fruit	Pistachio	Misc. Deciduous	Misc. Field Crop	Pasture	Nursery	Grapes	Native Vegetation	Water	Farmstead	Urban	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
16S/22E-34[e]	-	458	-	-	42	508	9	573	746	5736	1		6		2	1			84				6	X				X	X
17S/26E-30	1007	5488	923	4472	3307	35670	404	1779	3778	38238	83		4							13				X					X
17S/26E-35	1400	7974	3479	507	1674	22782	64	3603	3694	25890	73		5				6	1		4	2	1	4	X		X	X		X
18S/26E-04	3774	7272	206	884	3370	19658	155	2998	3420	23020	28	6	1						2	49	2		2	X	X				X
18S/27E-31	758	3517	448	2755	1502	16495	151	1047	1954	19601	14		0							69			17	X		X	X		X
24S/25E-23	1869	3707	-[d]	-	-	651	312	346	-	413			14	32		10		30						X	X				

[a] Tulare Co. land use data obtained from 1993 Department of Water Resources maps.

[b] Total pounds of pesticide applied from 1994-1999 in the monitored section, where well was located.

[c] Total pounds of pesticide applied from 1994-1999 in the monitored section plus the eight surrounding sections.

[d] None applied for 1994-1999.

[e] The well in 16S/22E-34 plots out in Tulare County. U.S.G.S. sampled the well assuming it was in Fresno County.